User Manual

Connection to PROFIBUS-DP

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SÜTRON ELECTRONIC GMBH

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2	22.11.2005	Validation extended, chapter "Important Notes" added

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1 Important Notes

1.1 Symbols

The symbols in this manual are used to draw your attention on notes and dangers.

Danger
This symbol is used to refer to instructions wich, if ignored or not carfully followed could result in personal injury.

Note
This symbol indicates application tips or supplementary notes.

Reference to source of information
This symbol refers to detailed sources of information on the current topic.

1.2 Safety Notes

- Read this manual carefully before using the operating device. Keep this manual in a place where it is always accessible to all users.
- Proper transportation, handling and storage, placement and installation of this product are prerequisites for its subsequent flawless and safe operation.
- This user manual contains the most important information for the safe operation of the device.
- The user manual, in particular the safety notes, must be observed by all personnel working with the device.
- Observe the accident prevention rules and regulations that apply to the operating site.
- Installation and operation must only be carried out by qualified and trained personnel.

1.3 Intended Use

- The device is designed for use in the industry.
- The device is state-of-the art and has been built to the latest standard safety requirements. However, dangerous situations or damage to the machine itself or other property can arise from the use of this device.
- The device fulfills the requirements of the EMC directives and harmonized European standards. Any modifications to the system can influence the EMC behavior.

1.4 Target Group

All configuration and programming work in connection with the automation system must be performed by trained personnel only (e.g. qualified electricians, electrical engineers).

The configuration and programming personnel must be familiar with the safety concepts of automation technology.

2 PROFIBUS-DP

Profibus DP provides a manufacturer- and controller-independent data transmission protocol. The Profibus DP is a speed-optimized Profibus variant that is specially tailored to communication between programmable controllers and decentralized peripheral devices.

Profibus DP is implemented in the operating device and meets the requirements of parts 1 and 3 of the German standard DIN 19245. It also corresponds to the European field bus standard EN 50170.

As the operating device fulfills standardization requirements, it can be successfully integrated as a slave into the Profibus DP.

All operating devices can be linked using an integrated Profibus DP additional module. You can also link several operating devices to one master controller.

The entire PROFIBUS DP protocol is handled by the protocol chip SPC3. Transfer speeds of up to 12 MBaud are possible.

The operating device is used in the bus as a decentralized module that occupies up to 256 inputs and outputs. The size can be programmed from between 8- and 32-byte IN data, and between 8- and 32-byte OUT data. Data transfer is carried out via the peripheral area.

The input/output image is exchanged cyclically between the master and operating device via the bus. In this context, the operating device uses the cyclical input/output image for data exchange between the master and the slave. The data content to be interpreted is defined for both partners in a data profile.

All services required for running the operating device originate in the operating device. The operating device has client functions.

The controller reacts to the requests of the operating device. It has server functions.

The master module must interpret the incoming data according to the profile and also respond according to the profile. This is carried out using a function block in the controller that is able to interpret the requests in the IN data, and write a response to the OUT data.

2.1 Specification for PROFIBUS-DP

The specification of the operating device in PROFIBUS DP is defined using the device data base (GSD) file SE03081A.GSD.

2.1.1 Diagnosis

The operating device implements the station-related diagnosis.

5-byte user diagnosis data is transferred

– 1st byte = error number (1 = communication error in the operating device)
– 2nd and 3rd byte communication error code
– 4th and 5th byte communication error subcode

The communication-error code and subcode are the values that are also displayed on the operating device.

2.2 Data Profile

To allow direct data access to the different data areas in a controller, a data profile must be agreed between the master and the slave.

The first four bytes of the telegram length set are used as follows:

– Telegram sequential number and length
– Definition of the access
– Definition of the data area

2.2.1 Request telegram

Table 2-1 Request telegram

Byte	Content	
1	Number of user data, sequential number of telegram	
2	Access	
3	Offset (Depends on Byte Order Setting)	Low (High)
4	High (Low)	
5	User Data 1st Byte	
6	User Data 2nd Byte	
n	User Data nth Byte	

Byte 1: Number of User Data

Table 2-2 Number of User Data

Bit	Content
0	Number of User Data in Bytes. Specifies the number of bytes for the user data transfer.
1	
2	
3	
4	
5	Sequential Number of the Telegram. Identification number for each communication process. (0 = initialization cycle, 1 - 7 = normal sequential number)
6	
7	

Byte 2: Access

Table 2-3 Access

Bit	Content
0	Byte Number For Word Access 0 = First Byte, 1 = Second Byte
1	Reserved
2	
3	
4	
5	Access: 00 = Bit 01 = Byte 02 = Word 03 = Double word
6	
7	Data Direction: 0 = Read 1 = Write

Byte 3 and 4: Offset

These bytes contain the address for accessing a data area.

Byte 5 ff: User Data

The user data are located from byte 5 onwards to the end of the telegram.

2.2.2 Response Telegram

Table 2-4 Response telegram

Byte	Content	
1	Number of User Data	
2	Access	
3	Return Code	Error
4		0x00
5	User Data 1st Byte	
6	User Data 2nd Byte	
n	User Data nth Byte	

2.2.3 User Data

The user data are located from byte 5 onwards to end of the telegram.

2.2.4 Reading and Writing Bytes

Depending on the telegram length and access, up to 28 bytes of user data can be transferred during reading and writing operations.

When bytes are being read and written, the user data appears in the telegram as of byte five.

2.2.5 Reading Bits

When the system reads bits, it reads a byte, word or double word, based on the address width of the data area to be read.

The operating device masks out the requested bits, and displays the data in line with the display settings.

2.2.6 Writing Bits

Only an individual bit is set or deleted.

The controller receives a bit mask and link information from the operating device via the request telegram. The bit is set or deleted in the target address using the bit mask and the link information.

The byte order of the bit mask for word addresses is oriented to the protocol parameters specified for the byte order.

Table 2-5 Writing to a byte address

Byte	Content
5	Bit Mask
6	Logical Operation 0 = AND 1 = OR

Table 2-6 Writing to a word address

Byte	Content
5	Bit Mask LOW
6	Bit Mask HIGH
7	Logical Operation 0 = AND 1 = OR

2.3 Programming

2.3.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

2.3.1.1 Maximum Waiting Time For Response

This parameter specifies how long the operating device waits for a response from the controller.

Table 2-7 Maximum waiting time for response

Configurable Values	Default Value
1 ms to 65535 ms	1000 ms

2.3.1.2 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 2-8 Delay until connection set-up

Configurable Values	Default Value
1000 ms to 65535 ms	5000 ms

2.3.1.3 Station Number

Specifies the station number of the operating device within the PROFIBUS-DP structure. The station numbers 0 to 2 are reserved.

Table 2-9 Station number

Configurable Values	Default Value
3 to 124	3

2.3.1.4 Telegram Length

The telegram length is set to the PROFIBUS configuration. Specigy the same value in the PROFIBUS programming software.

Table 2-10 Telegram length

Configurable Values	Default Value
8 Byte to 32 Byte	20 Byte

2.3.1.5 Floating Point Numbers in the Siemens Format

This parameter specifies whether floating point numbers are exchanged in the Siemens-specific format or IEEE format.

Table 2-11 Floating point numbers in the Siemens format

Configurable Values	Default Value
OFF	X
ON	

2.3.1.6 Timer and Counter in the Siemens Format

This parameter specifies wether timer and counter are exchanged in the Siemens-specific format or IEEE format.

Table 2-12 Timer and counter in the Siemens format

Configurable Values	Default Value
OFF	X
ON	

2.3.1.7 Byte Order

Specify the byte order for word and double-word addresses. (Siemens = High-Low, Bosch = Low-High)

Table 2-13 Byte order

Configurable Values	Default Value
Low-High	X
High-Low	

2.3.1.8 Address Width

Specify the address width you want the operating device to use when accessing controller addresses.

Table 2-14 Adress width

Configurable Values	Default Value
1 = Byte Address	
2 = Word Address	X
4 = Doppel-Word Address	

2.3.2 Polling Area

Limits applying to the poll area:

– The variable must be word-oriented.
– The area must be contiguous.
– The controller must be able to access this area in bit-mode.
– The operating device must be able to access this area in word-mode.

2.3.3 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

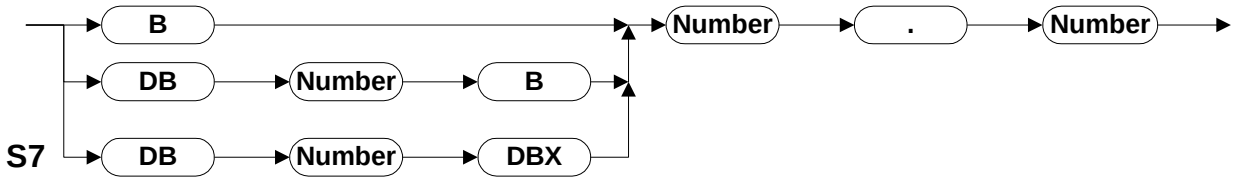

Figure 2-1 Syntax diagram for bit access, PROFIBUS-DP.

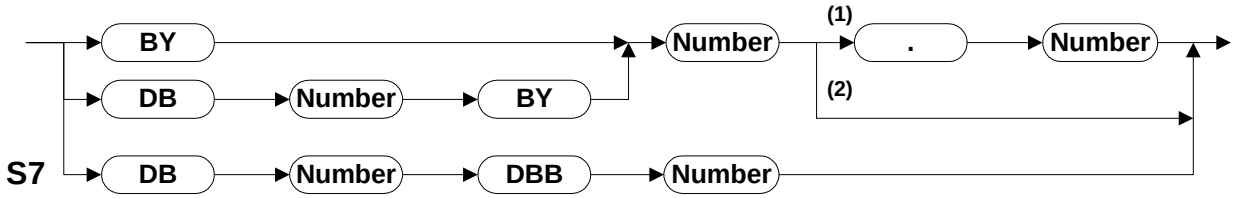

Figure 2-2 Syntax diagram for byte access, PROFIBUS-DP.

1 The number in front of the point is a word or double-word address. The number after the point specifies the byte number within the word/double word.

2 The number in front of the point is a byte address.

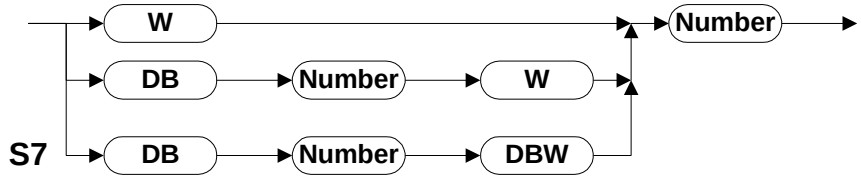

Figure 2-3 Syntax diagram for word access, PROFIBUS-DP.

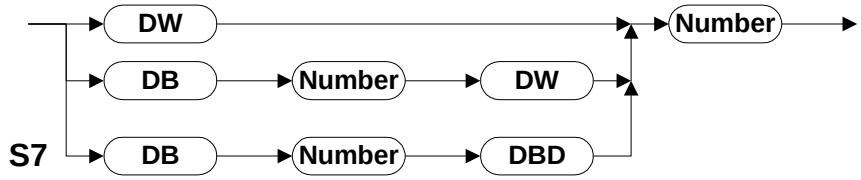

Figure 2-4 Syntax diagram for double-word access, PROFIBUS-DP

2.4 Physical Connection

2.4.1 Pin Assignment

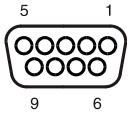

Figure 2-5 9 pin D-SUB female connector strip

Connector in the terminal: 9 pin D-SUB female connector strip.

Table 2-15 Pin assignment PROFIBUS DP

Pin	Designation	Function
1	nc	Not Connected
2	nc	Not Connected
3	RxD/TxD-P	Received Data / Transmitted Data Plus
4	CNTR-P	Repeater Control Signal Plus
5	DGND	Data Transmission Potential
6	VP	Supply Voltage of Terminators Plus
7	nc	Not Connected
8	RxD/TxD-N	Received Data / Transmitted Data Minus
9	CNTR-N	Repeater Control Signal Minus

2.4.2 Cable for PROFIBUS-DP

In the wiring depicted below, the potential difference between the data reference potentials DGND of all connections are NOT to exceed +/- 7 V.

Ensure that no compensating current flow through the bus cable shield. Install a separate equipotential bonding conductor.

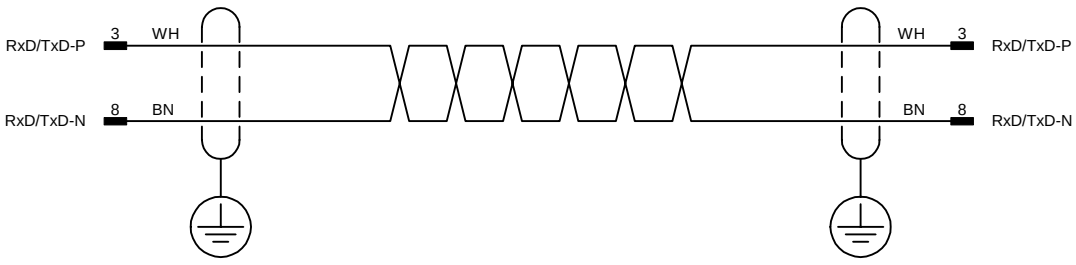

Figure 2-6 Connecting cable PROFIBUS-DP

There are two cable specifications for PROFIBUS-FMS and PROFIBUS-DP:

Table 2-16 Cable specification for PROFIBUS

Parameter	Cable type A	Cable type B
Wave Impedance	135 to 165 Ohm (for f = 3 to 20 MHz)	100 to 135 Ohm (for f > 100 MHz
Cable capacity	< 30 pF/m	< 60 pF/m
Wire cross-section	> 0.34 mm^2	> 0.22 mm^2
Loop Impedance	< 110 Ohm/km	---
Signal attentuation	max. 9 dB	max. 9 dB
Cable type	twisted-pair 1 x 2 / 2 x 2 / 1 x 4 wires	twisted-pair1x 2 / 2 x 2 / 1 x 4 wires
Shielding	Copper braided shielding or braided shielding + foil shielding	Copper braided shielding or braided shielding + foil shielding

Cable recommendations:

Table 2-17 Cable recommendations for PROFIBUS

Field of Application	Manufacturer	Order Number
Standard	Siemens	6XV1 830-0AH10
Trailing cable	Siemens	6XV1 830-3BH10

Connector recommendations:

Table 2-18 Connector recommendations for PROFIBUS

Manufacturer	Order Number
Siemens	6ES79 0BA20-0XA0

2.4.3 Transfer Speed and Line Length

With the PROFIBUS, data can be transferred using different transfer speeds. However, the higher the transfer speed, the shorter the maximum permitted line length. The values listed in the following table apply to the cable type A which is more closely specified in DIN E 19245 part 3.

Table 2-19 Transfer speed versus line length for PROFIBUS

Baud Rate (Bit/s)	Line Length (m)
187 500	1000
500 000	400
1 500 000	200
3 000 000	100
6 000 000	100
12 000 000	100

2.5 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows:

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 2-20 Fehlermeldungen PROFIBUS-DP

Code	Subcode	Error Type	Possible Cause
1			
	1	Slave is currently not ready	
	2	Packets out of sequence	
	3	Protocol framing error	
	4	Timeout	
	5	CRC error	
	6	Parity error	
	7	Send process aborted	
	8	Receive process aborted	
	9	Buffer too small for cyclic data	
	10	No cyclic data defined	
	12	Cyclic data already defined	
	15	The selected protocol is not supported	
	16	Receive buffer overrun	
	40	Undefined system variable	
50		Error initializing the SPC3	
	1	Buffer too large	
	2	No initialization of SPC3	
	4	No memory for telegram buffer	
60		No configuration from master	
61		Wrong input length	
62		Wrong output length	
63		Error in configuration data, reparameterization required	
64		Protocol chip requires configuration update, reparameterization required.	
65		No communication via protocol chip, reparameterization required.	

Table 2-20 Fehlermeldungen PROFIBUS-DP

Code	Subcode	Error Type	Possible Cause
66		Protocol chip reset, reparameterization required.	
67		Watchdog time error, reparameterization required.	
70		Operating device is not polled	
	0	Distinguishing feature for manufacturer	
	1	Distinguishing feature for manufacturer	
71	xxx	No response to order. xxx = variable number	
100		Base no. for error from PLC function block. PLC error is added to 100. The subcode indicates the offset value for the access, during which the error occurred.	
	i.e. 102	Access to DB via FB111 / FB112 DB does not exist	

2.6 Applications

The controller program, which is usually a function block, must handle the requests of the operating device in line with the data profile.

The details depend on the controller. The following sections explain the controller-specific applications that have been developed to date.

The device data base (GSD) file SE03081A.GSD can be used to set the parameters of the operating devices in the PLC software. This file is available in a subdirectory of the programming software and in our Internet download area.

2.6.1 Siemens S7 Controllers

The following dialog boxes and the way in which they are used may vary in the different versions of Step7 software. The procedure for defining a PROFIBUS DP slave is the same in all versions, but is not described in this documentation. The dialog boxes depicted here were developed for version 5.1 of an S7-300 controller.

2.6.1.1 Hardware Configurator

To integrate the operating device into the PROFIBUS DP structure, you must firstly introduce the operating devices into the system.

Proceed as follows:

1. Start the Hardware Configurator in S7.
2. From the **Options** menu, select the menu item **Install New GSD**.

The following dialog opens.

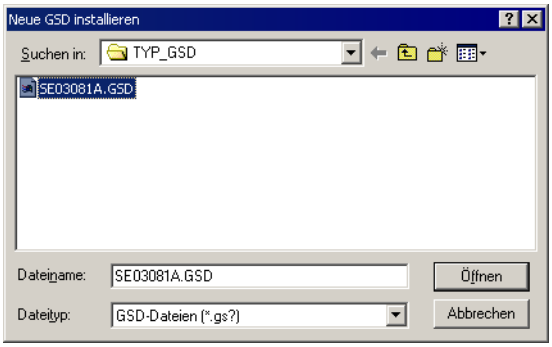

Figure 2-7 Dialog 'Install New GSD'

3. From your main TSwin directory navigate to the subdirectory ..\FBs\Profibus\TYP_GSD.
4. Select the file SE03081A.GSD.
5. Click 'Open' to confirm your selection.

In the hardware catalog, the operating device is then listed as follows:

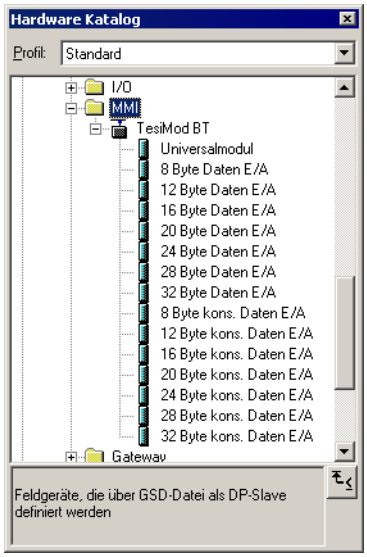

Figure 2-8 Hardware catalog

To integrate the operating device into PROFIBUS-DP, do the following:

1. Click on the TesiMod BT item and, keeping the mouse button pressed, drag and drop this item to the icon for the PROFIBUS DP master system.

The pointer becomes a cross.

2. Release the mouse button.

The following dialog opens.

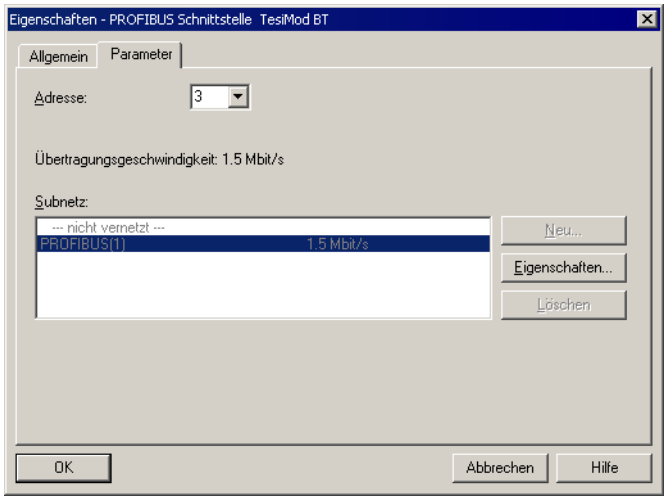

Figure 2-9 Dialog 'Properties - PROFIBUS interface TesiMod BT

3. Specify an address for the operating device (3).
4. Click OK to confirm your actions.

The hardware configurator now looks as shown below:

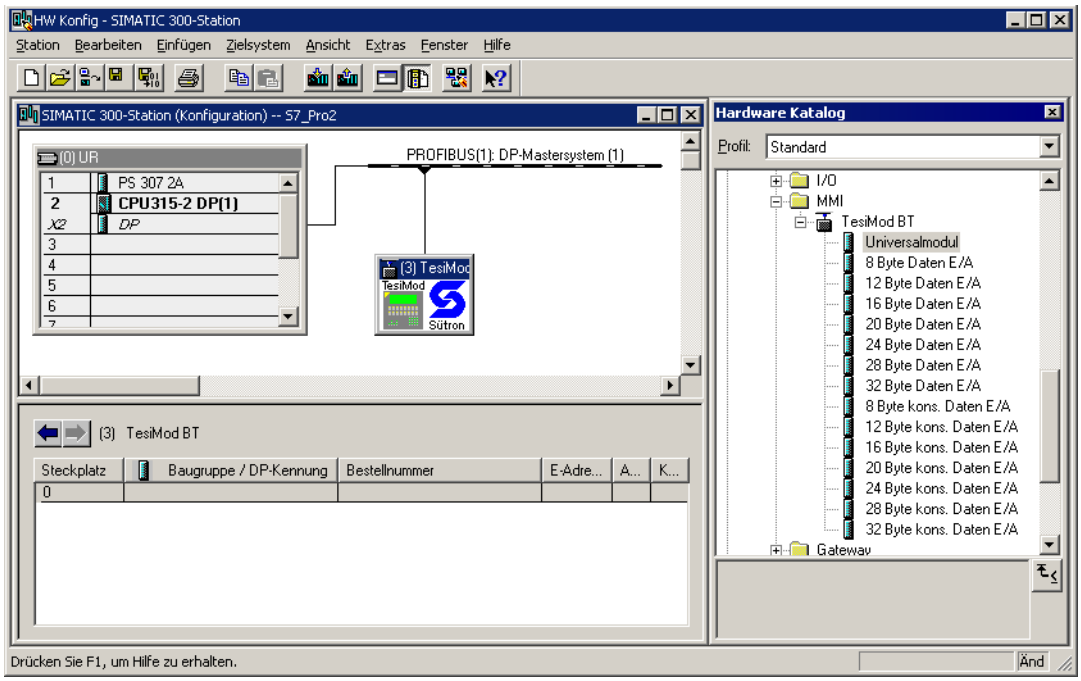

Figure 2-10 Hardware configuration

You must also set the parameters for the operating device as a DP slave. Proceed as follows:

1. Click on the element Universal Module and, keeping the mouse button pressed, drag and drop the element to the top line in the table.

The pointer becomes a cross.

Release the mouse button.

The item is entered into the table.

2. Select the menu item Object Properties from the Edit menu.
3. Specify the properties as shown below.

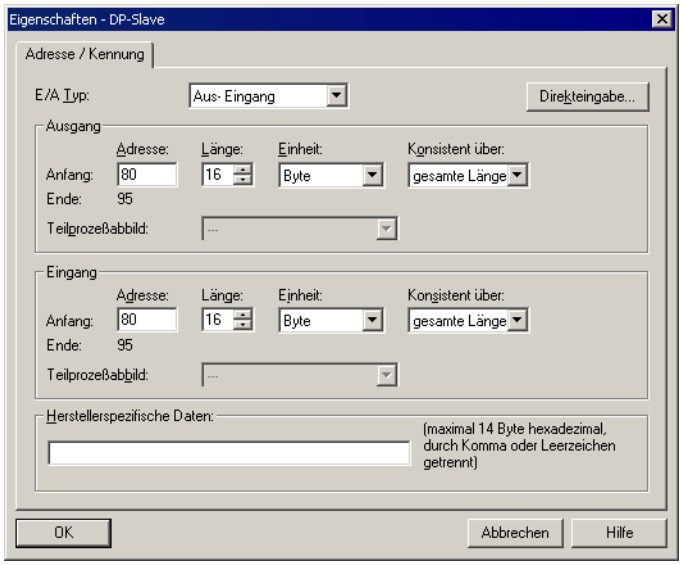

Figure 2-11 Dialog Properties - DP Slave

You can select your entries for address, length, and unit as needed. The settings depicted below generate the value 191 in the ID byte.

2.6.1.2 PROFIBUS Function Blocks

You need Sütron function blocks to interpret and evaluate the data. The cyclical call sequence of the function blocks must be adhered to.

2.6.1.3 Importing the STL Source Files

Import the STL (AWL) files supplied with the product in the Simatic Manager.

Proceed as follows:

1. Select the **Sources** folder in the Simatic Manager.
2. From the **Insert** menu, select the menu item **External Source**.

The following dialog opens.

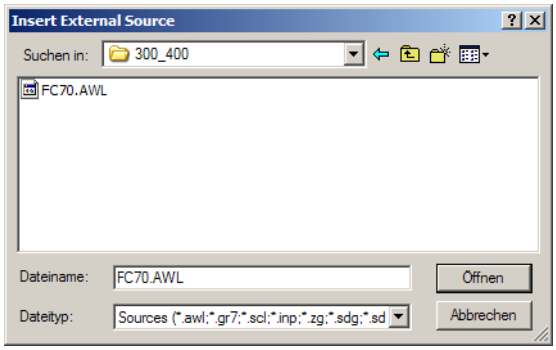

Figure 2-12 Dialog Insert External Source

3. From your main TSwin directory navigate to the subdirectory ..\FBs\PROFIBUS\SIEMENS\S7\300_400.
4. Select the STL file FC70.AWL and select Open to confirm.

The name is now entered in the Sources folder in the S7 Manager.

5. Open the STL file, and compile and convert it into the S7 function block format.

2.6.1.4 General Functioning

The peripheral data is processed using the functions SFC14 and SFC15 of the S7 CPU. SFC14 reads the peripheral data, and SFC15 writes the data to the periphery. FC80 takes on the data provided by SFC14 and calls the read or write function, and transfers the data read to SFC15. The local data stack of FC80, FC81, and FC82 is used to process protocol data.

SFC14, FC70 (FC80) and SFC15 must be called cyclically in the program.

The following cyclical call sequence must be adhered to:

1 SFC14

2 FC70 (FC80)

3 SFC15

The functions FC80, FC81, and FC82 use the register-indirect, cross-area address form. If interrupt-controlled program calls are permitted in the program cycle, the contents of the address registers 1 and 2, and possibly also the local data stack, may need to be saved, in addition to the contents of both accumulators.

The operating device can access the controller data on a bit, byte, word, or double-word basis. Bit access is possible to a byte address. As the protocol profile itself does not transfer data type code, these are transferred using the variable numbers. Each variable is uniquely identified using a variable number. This number is defined during programming.

The following graphic shows how the function blocks work.

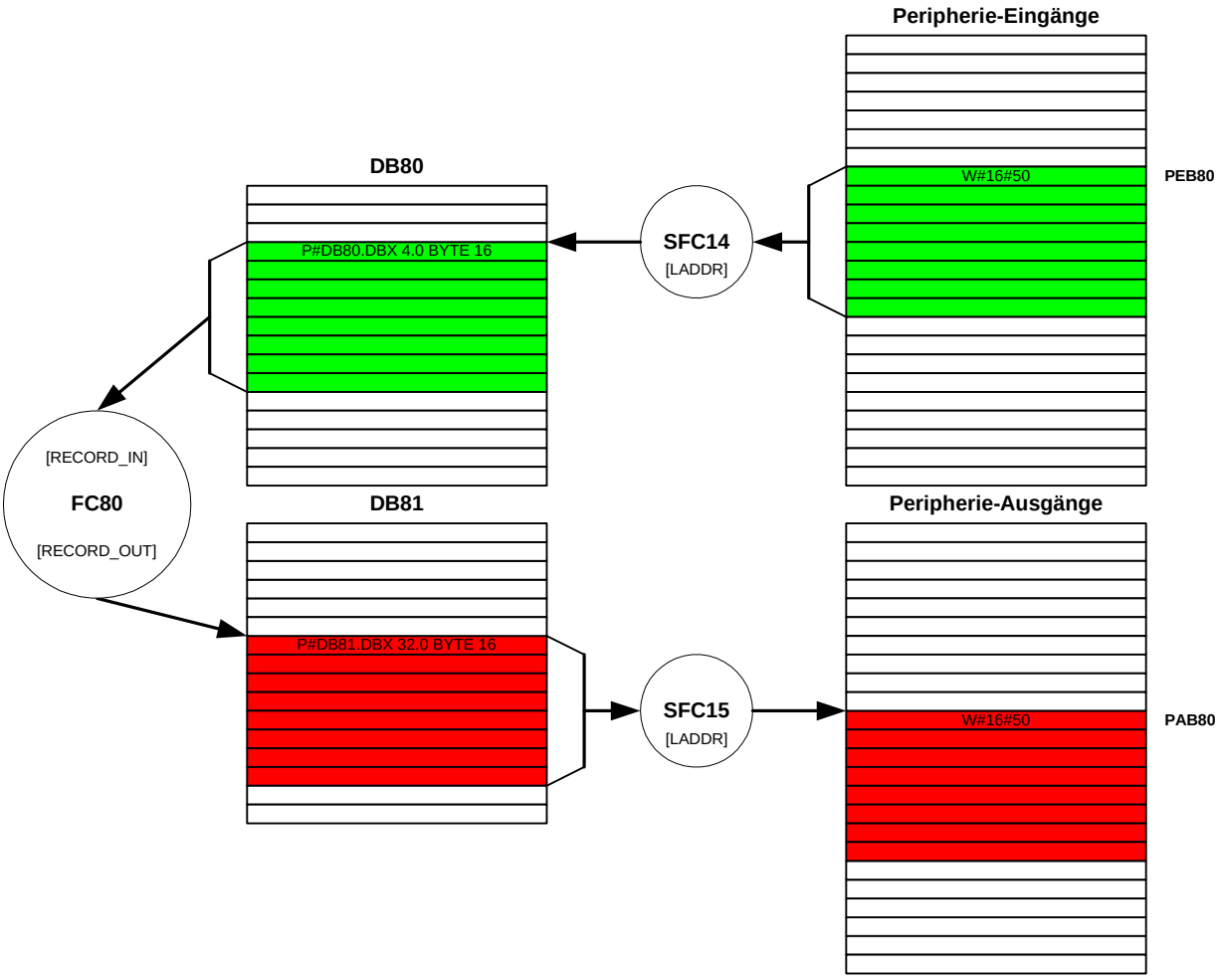

Figure 2-13 How the function blocks work

2.6.1.5 SFC14 Functioning

SFC14 reads the data from the peripheral inputs, starting with the start address (LADDR) and copies the data to a specific target (RECORD). The amount of data to be copied is contained in the RECORD parameter.

Table 2-21 SFC14 parameters

Name	Meaning
LADDR	Specifies the start address for the peripheral inputs of the operating device (hexadecimal)
RET_VAL	Return value of the SFC14 in case of an error
RECORD	Copy target for the read peripheral data

2.6.1.6 FC80 Functioning

FC80 reads the data transferred from the operating device from the copy target RECORD of SFC14. Based on the telegram transferred, it carries out a read or write access. It then transfers the data to be transferred to the operating device to the source data area of SFC15.

Table 2-22 FC80 parameters

Name	Meaning
Record_In	Start address for the input data (= parameter RECORD of the SFC14)
Record_Out	Start address for the output data (= parameter RECORD of the SFC15)

2.6.1.7 SFC15 Functioning

SFC15 reads the data from the source RECORD and copies the data to the peripheral outputs, starting with the address LADDR. The amount of data to be copied is contained in the RECORD parameter.

Table 2-23 SFC15 parameters

Name	Meaning
LADDR	Specifies the start address for the peripheral outputs of the operating device (hexadecimal)
RET_VAL	Return value of the SFC15 in case of an error
RECORD	Copy source for the data to be transferred

2.6.1.8 Example for an OB1

The following example refers to the connection of one operating device to the PROFIBUS-DP.

```
...
//
Call           SFC  14
   [LADDR]      :=  W#16#50
   [RET_VAL]    :=  MW62
   [RECORD]     :=  P#DB80.DBX 4.0 BYTE 16
//
Call            FC  80
   [RECORD_IN]  :=  P#DB80.DBX 4.0 BYTE 16
   [RECORD_OUT] :=  P#DB81.DBX 32.0 BYTE 16
//
Call           SFC  15
   [LADDR]      :=  W#16#50
   [RECORD]     :=  P#DB81.DBX 32.0 BYTE 16
   [RET_VAL]    :=  MW64
...
   BE
```

2.6.1.9 Defining Variables

Specify the variable addresses in either the hexadecimal notation or using the following syntax formats:

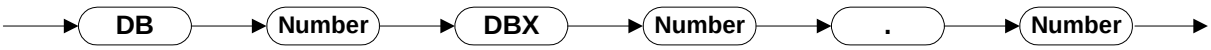

Figure 2-14 Bit access for PROFIBUS using a Siemens S7

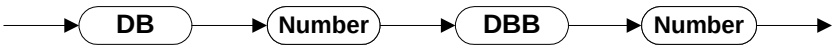

Figure 2-15 Byte access for PROFIBUS using a Siemens S7

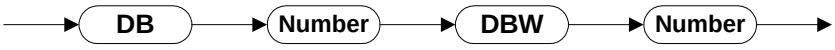

Figure 2-16 Word access for PROFIBUS using a Siemens S7

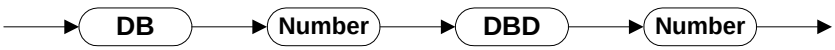

Figure 2-17 Double-word access for PROFIBUS using a Siemens S7

2.6.2 Siemens S5 Controllers

The PLC program communicates with the PROFIBUS DP via the input/output peripheral area.

A separate IN/OUT data channel is assigned to each participant on the PROFIBUS DP (each connected operating device). The assignment is made via the parameterization of the PROFIBUS-DP master module in the Siemens PLC. Controllers in the S5 series usually use the module IM308B or IM308C.

2.6.2.1 Parameter Settings for IM308B

A device type file for the COMET200 programming software is available to parameterize the IM308B.(BT081ATD.200)

The 'Configuration' option is used to configure the terminal of the DP slave.

The following parameters are specified:

1. Position of the operating device in the peripheral area, i.e. the I/O addresses on which the operating device is located.
2. The DP identifier via module 0

Table 2-24 The DP identifier via module 0

Item	Value
I/O	X
Length	4, 6, 8, 14, 16
Format	Word
Consistency	0 Word Consistency

3. Data for the parameterization telegram are not applicable, no entry.

Using a program module, this module configuration is loaded into the module with the parameter settings of the entire master module.

2.6.2.2 Data Consistency

A data consistency over the entire length set must be applied for exchanging data between the operating device and the master module.

However, the master modules IM308B and IM308C only ensure a consistency with a data width of up to one word.

Program-specific measures in the PROFIBUS DP driver of TesiMod operating devices ensure consistency up to the maximum data length which can be specified, that is 32 bytes.

2.6.2.3 PLC Program

Evaluation of the Control Bytes:

The PLC program must cyclically poll the peripheral area that is assigned to the operating device. Using the sequential number, it must check whether a new request has been received from the operating device.

FB110 carries out this task.

FB110 is parameterized with the peripheral address of the corresponding operating device, to ensure that only one function block is required to connect several operating devices.

FB110 must also copy bytes 1 and 2, unchanged, from the request to the response telegram, and 0x00 must be written to byte 3.

Take note of the consistency settings when reading and writing to the peripheral area. (Also see the COMET200 manual.)

Processing user data:

Separate read and write function blocks that are called by FB110 are used to process user data.

The read and write function blocks process the user data in line with the data profile.

Error Handling:

Errors can be entered in the return code, byte 4 of the response telegram. If no error occurs, byte 4 must be deleted.

One possible error is: DB does not exist.

2.6.2.4 FB110 Evaluation Block

The description for this function block is for version 2.0 and higher (PROF02ST.S5D).

The function block (FB) uses MW246 - MW254 as scratch flag.

The function block also needs a separate data word for each operating device. The data word is transferred as a parameter during the call. The telegram sequential number is saved in this data word.

FB110 cyclically checks the contents of byte 1 - bits 5 to 7.

If the value 0 is contained here, the telegram number memory is reset.

If in byte 1, bits 5 to 7 are not equal to the content of the telegram number memory, a new request telegram has been received from the operating device, and this must be evaluated and a response sent.

FB110 is called cyclically in OB1 with the corresponding parameters for each operating device.

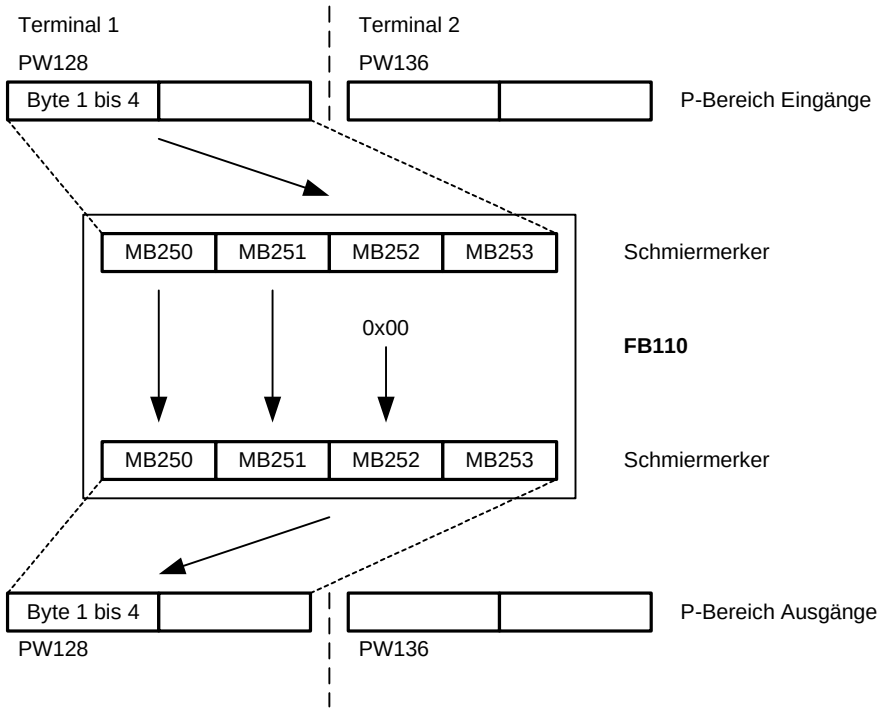

Figure 2-18 Structure of FB110

2.6.2.5 FB111 - Reading from the Data Block

The description for this function block is for version 2.0 and higher (PROF02ST.S5D).

The function block interprets the following bytes in the telegram as follows:

– Byte 2, bit 0 is interpreted as a byte code for a byte access to a word address.

Table 2-25 FB111 - Byte code in byte 2

Value	Meaning
0	DL - High Byte
1	DR - Low Byte

– Byte 3 contains the data block number.
– Byte 4 contains the data word number within the DB.

Siehe Kapitel „Data Profile“ auf Seite 2-2.

2.6.2.6 FB112 - Writing to the Data Block

The description for this function block is for version 2.0 and higher (PROF02ST.S5D).

The function block interprets the following bytes in the telegram as follows:

– Byte 2, bit 0 is interpreted as a byte code for a byte access to a word address.

Table 2-26 FB111 - Byte code in byte 2

Value	Meaning
0	DL - High Byte
1	DR - Low Byte

– Byte 3 contains the data block number.
– Byte 4 contains the data word number within the DB.
– Byte 5 and
– Byte 6 contain the bit mask for the logical operation.
– Byte 7 contains the logical instruction (AND / OR).

Siehe Kapitel „Data Profile“ auf Seite 2-2.

2.6.2.7 Protocol Parameters for the Siemens S5 Series

For the protocol, specify the parameters shown in the figure below.

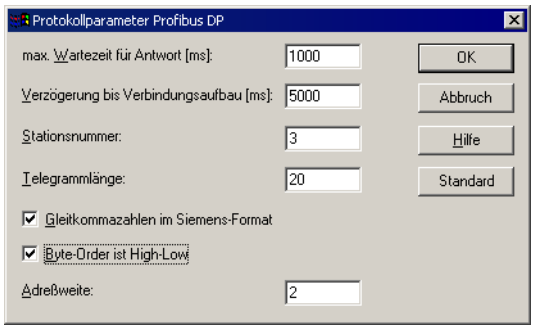

Figure 2-19 Protocol parameters for PROFIBUS using a Siemens S5

2.6.2.8 Defining Variables

Specify the variable addresses in either the hexadecimal notation or using the following syntax formats:

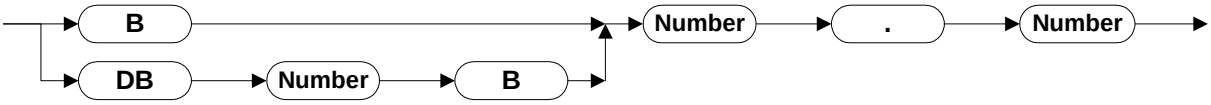

Figure 2-20 Bit access for PROFIBUS using a Siemens S5

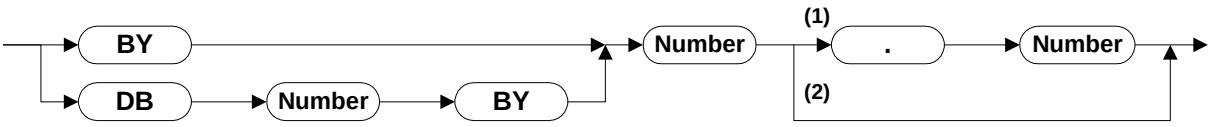

Figure 2-21 Byte access for PROFIBUS using a Siemens S5

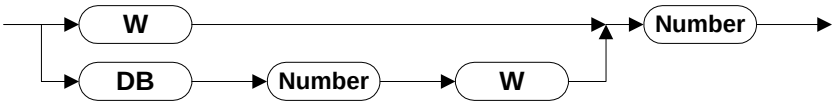

Figure 2-22 Word access for PROFIBUS using a Siemens S5

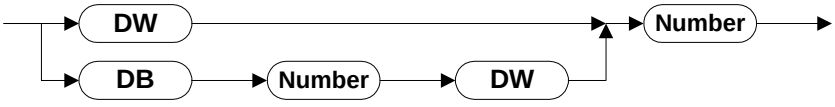

Figure 2-23 Double-word access for PROFIBUS using a Siemens S5

2.6.3 Rexroth Controllers

The PLC program communicates with the PROFIBUS DP via the input/output peripheral area.

Each participant, including each operating device in the PROFIBUS DP, is assigned an IN and OUT data channel.

The channel is assigned using the parameterization of the Bosch controller's PROFIBUS DP master module. The module MP-DP12 is used in Bosch controllers.

2.6.3.1 Configuration in WINSPS

Evaluation of the control bytes in the PLC Program:

The PLC program must cyclically poll the peripheral area that is assigned to the operating device. Using the sequential number, it must check whether a new request has been received from the operating device. In addition, bytes 1 and 2 must be copied, unchanged, from the request telegram to the response telegram, and 0x00 must be written to byte 3.

You require the following modules for this task. They are contained in a subfolder of the programming software's installation folder.

Table 2-27 Function blocks for the programming software WINSPS

Controller	Function Block
CL200	..\FBs\Profibus\BOSCH\WINSPS\CL200\BT_PB2.pxl
CL300	..\FBs\Profibus\BOSCH\WINSPS\CL345\BT_PB345.pxl
CL400	..\FBs\Profibus\BOSCH\WINSPS\CL345\BT_PB345.pxl
CL500	..\FBs\Profibus\BOSCH\WINSPS\CL345\BT_PB345.pxl
SoftSPS	..\FBs\Profibus\BOSCH\WINSPS\PLC\BT_PBPLC.pxl

Error Handling in the PLC Program:

Errors can be entered in the return code, byte 4 of the response telegram. If no error occurs, byte 4 must be deleted. Possible errors are:

– DB does not exist.

Function Blocks Supplied:

You must configure the operating device as the slave using 'n Byte kons. Daten E/A' (n byte cons. data I/O) in the DP master module.

If you are using interrupts, you must save the scratch flags and the four registers used in the interrupt OB.

Inserting the Library Files in WINSPS

1. Start WinSPS.
2. Copy the corresponding pxl file to the ZSO directory of the PLC project.

You can only copy the file to the appropriate project directory as modules of the incorrect controller type are not recognized!

3. Assign the library in the toolbar.

Example:

```
FC10, R BT_PB345
```

4. Open the editor in the PLC software.

Example:

OB1

Select the PROFIBUS block from the 'Edit/Parameter list' menu.

Parameterizing the call-up function:

Example:

For two operating devices:

```
...
;DEF für Gerät 1
DEF                 10,-EZ_Basisn
DEF                 10,-AZ_Basisn
DEF                 DB50,-DBNR
DEF                 0,-WDNR
DEF                 20,-TLNG
;DEF für Gerät 2
DEF                 10,-EZ_Basisn2
DEF                 10,-AZ_Basisn2
DEF                 DB50,-DBNR2
DEF                 0,-WDNR2
DEF                 20,-TLNG2
;Aufruf Gerät 1
BA                  -BT_345,5FC10
P0              W   -EZ_Basisn
P1              W   -AZ_Basisn
P2                  -DBNR
P3              W   -WDNR
P4              W   -TLNG
;Aufruf Gerät 1
BA                  -BT_345,5FC10
P0              W   -EZ_Basisn2
P1              W   -AZ_Basisn2
P2                  -DBNR2
P3              W   -WDNR2
P4              W   -TLNG2
...
```

Function Block BT_PB345:

The function block BT_DP345 is used to decode the transfer protocol of the operating devices. It ensures consistent data transfer.

When you program the controller, note that a total of 64 bytes as of the address DB[P2] W[P3] are reserved for processing the protocol. Other program components cannot use this area!

The function block BT_PB345 uses the following parameters:

Table 2-28 Parameters for function block BT_PB345

Parameter	Function
P0	EZ Base Address
P1	AZ Base Address
P2	Data block for storing the EZ/AZ data
P3	Base Address in Data Block [P2]
P4	Telegram Length corresponds to the number of EZ/AZ data of the slave configuration (8, 12, 16, 20, 28, or 32 bytes)

2.6.3.2 Configuration in PROFI

Table 2-29 Function blocks for the programming software PROFI

Controller	Function Block
CL200	..\FBs\Profibus\BOSCH\PROFI\CL200\BT_MAIN.PBO ..\FBs\Profibus\BOSCH\PROFI\CL200\BT_READ.PBO ..\FBs\Profibus\BOSCH\PROFI\CL200\BT_WRITE.PBO ..\FBs\Profibus\BOSCH\PROFI\CL200\OB1.PBO
CL300	..\FBs\Profibus\BOSCH\PROFI\CL350400/BT_MAIN.PCO ..\FBs\Profibus\BOSCH\PROFI\CL350400\BT_READ.PCO ..\FBs\Profibus\BOSCH\PROFI\CL350400\BT_WRITE.PCO ..\FBs\Profibus\BOSCH\PROFI\CL350400\OB1.PCO
CL400	..\FBs\Profibus\BOSCH\PROFI\CL350400/BT_MAIN.PCO ..\FBs\Profibus\BOSCH\PROFI\CL350400\BT_READ.PCO ..\FBs\Profibus\BOSCH\PROFI\CL350400\BT_WRITE.PCO ..\FBs\Profibus\BOSCH\PROFI\CL350400\OB1.PCO
CL500	..\FBs\Profibus\BOSCH\PROFI\CL500/BT_MAIN.P5O ..\FBs\Profibus\BOSCH\PROFI\CL350400\BT_READ.P5O ..\FBs\Profibus\BOSCH\PROFI\CL350400\BT_WRITE.P5O ..\FBs\Profibus\BOSCH\PROFI\CL350400\OB1.P5O

Function Block BT_MAIN

Structure of the block:

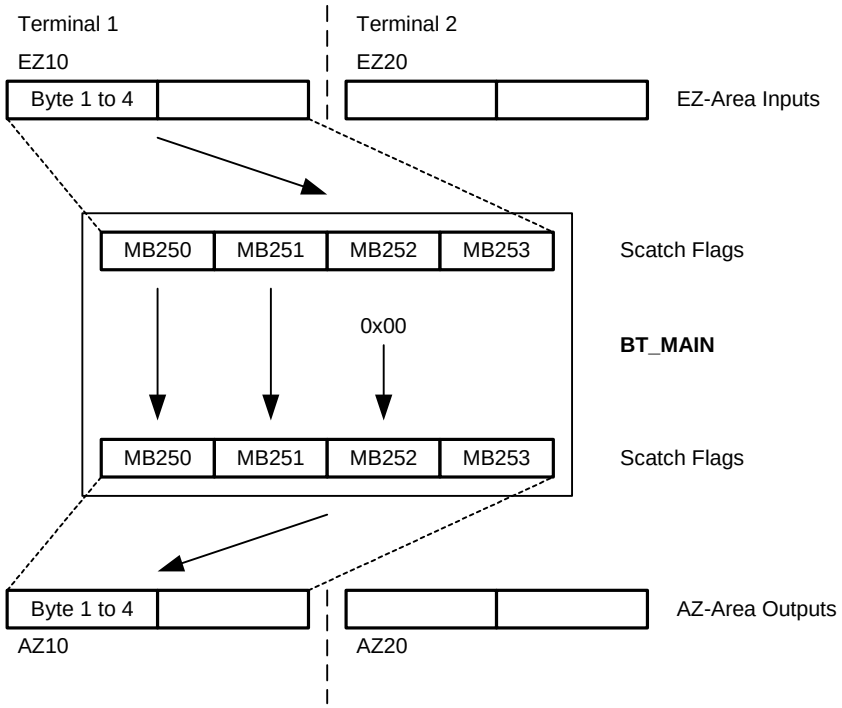

Figure 2-24 Structure of the BT_MAIN

Function Block BT_MAIN Call-Up

Example:

Call-up in OB1

```
;OB1 Organisationsbaustein
;**************************************
;Profibus-DP-Koomunikation mit Bediengerät
;Beispiel zur Einbindung im OB1
;**************************************
;Befehle notwendig für Profibus
L  W         EZ2,A  ;Adresse muss mit Koppeladresse übereinstimmen
T  W         A,AZ2  ;nur für CL400
;Einmal pro Bediengerät aufrufen
BA -BT_MAIN,4       ;Aufruf für das erste Bediengerät
;                   +---+
P0 W           K10  ; < ! Adresse des Eingangsbereichs
P1 W           K10  ; < ! Adresse des Ausgangsbereichs
P2 W           DB0  ; < ! Nummer des Datenbausteins
P3 W            D0  ; < ! Datenwortnummer
;                   +---+
PE
```

Function Block BT_READ

The function block BT_READ interprets the subsequent bytes in the telegram as follows:

– Byte 2, bit 0 is interpreted as a byte code for a byte access to a word address.

Table 2-30 Byte code in byte 2

Value	Meaning
0	Odd Address - Low Byte
1	Even Address - High Byte

– Byte 3 contains the data block number.
– Byte 4 contains the data word number within the DB.

The program module doubles the data word number for the even-numbered byte number in the DB.

Function Block BT_WRITE

The function block BT_WRITE interprets the subsequent bytes in the telegram as follows:

– Byte 2, bit 0 is interpreted as a byte code for a byte access to a word address.

Table 2-31 Byte code in byte 2

Value	Meaning
0	Odd Address - Low Byte
1	Even Address - High Byte

– Byte 3 contains the data block number within the DB.
– Byte 4 contains the data word number within the DB (0 to 255).
– Byte 5 and
– Byte 6 contain the bit mask for the logical operation.
– Byte 7 contains the logical instruction (AND / OR).

Parameterization of the BM-DP12 Module

Set the parameters for the module using the Bosch DP software.

The device data base (GSD) file SE03081A.GSD which is supplied is directly read in by the DP software. This means that the data required to set the parameters of the operating devices are automatically available.

Select the operating device with the required data width.

The function block copies bytes 1 and 2, unchanged, from the request telegram to the response telegram, and writes 0x00 to byte 3.

The function block uses MW248 to MW254 as scratch flags.

For each operating device, the program block also requires any data word of a data block. The data word is transferred as a parameter during the call. The telegram sequential number is saved in this data word.

The function block cyclically checks the content of byte 1 – bits 5 to 7.

If the value 0 is contained here, the telegram number memory is reset.

If in byte 1, bits 5 to 7 are not equal to the content of the telegram number memory, a new request telegram has been received from the operating device, and this must be evaluated and a response sent.

The function block is called cyclically in OB1 with the corresponding parameters for each operating device.

2.6.3.3 Protocol Parameters for BM DP12

Set the following parameters for the protocol:

Table 2-32 Protocol parameters for the Bosch CL series

Parameter	Value
Maximum Waiting Time for Response [ms]	1000
Delay Until Connection Set-Up [ms]	5000
Station Number	3
Telegram Length	16
Floating Point Number in the Siemens Format	Inactive
Byte Order is High-Low	Inactive
Address Width	2

Set the parameters using the Bosch DP software. The supplied device data base file SE03081A.GSD is directly imported by the DP software. Therefore, the data required to set the parameters of the operating devices are available in the DP software. You can specify 8, 12, or 16 bytes for the telegram length.

2.6.3.4 Protocol Parameters for the Bosch CL Series

Set the following parameters for the protocol:

Table 2-33 Protocol parameters for the Bosch CL series

Parameter	Value
Maximum Waiting Time for Response [ms]	1000
Delay Until Connection Set-Up [ms]	5000
Station Number	3
Telegram Length	20
Floating Point Number in the Siemens Format	Inactive
Byte Order is High-Low	Inactive
Address Width	2

2.6.3.5 Defining Variables

Specify the variable addresses in either the hexadecimal notation or using the following syntax formats:

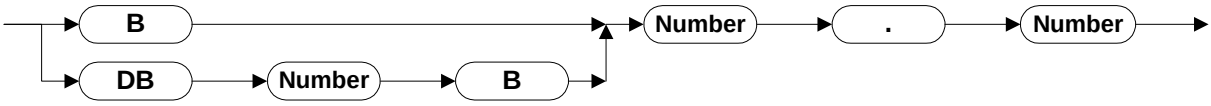

Figure 2-25 Bit access for PROFIBUS using the Bosch CL series

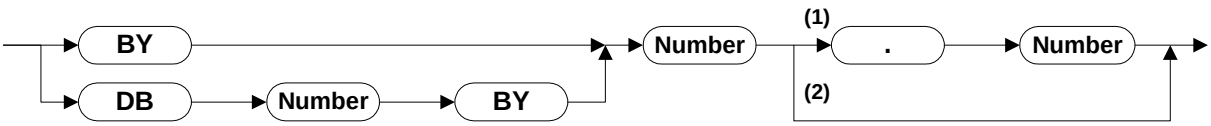

Figure 2-26 Byte access for PROFIBUS using the Bosch CL series

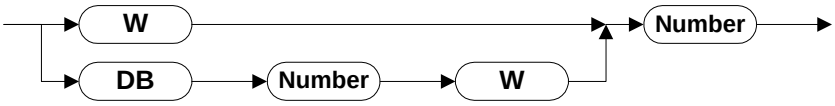

Figure 2-27 Word access for PROFIBUS with the Bosch CL series

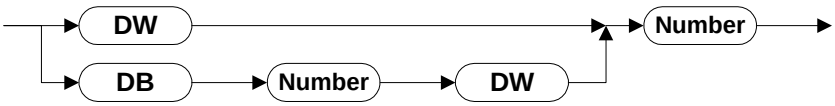

Figure 2-28 Double-word access for PROFIBUS using the Bosch CL series

In the variable list of the programming software, you can also enter the addresses in hexadecimal notation:

Table 2-34 Hexadecimal notation for addresses

Variable Name	Address (hex)	Low-Bit	High-Bit	PLC Access	PLC Address
Var1	DW H124B			Double Word	DB18 D150 to D153
Var2	W H124B			Word	DB18 D150 and D151
Var3	BY H124B			Byte	DB18 D151
Var4	BY H124B	1	1	Bit	DB18 D150 Bit 5
Var5	B H124B	13	13	Bit	DB18 D151 Bit 5

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Sütron electronic GmbH
Kurze Straße 29
D-70794 Filderstadt
Phone: 0049 711 / 77098-0
Fax: 0049 711 / 77098-60
E-mail: doku@suetron.de
Internet: www.suetron.com

SÜTRON
ELECTRONIC GMBH